
Transil™, transient voltage surge suppressor (TVS)

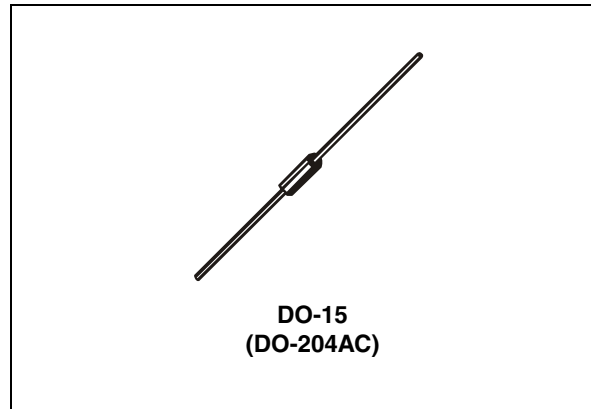
Datasheet – production data

Features

- Peak pulse power: 600 W (10/1000 μ s)
- Stand-off voltage range 6.8 to 440 V
- Unidirectional and bidirectional types
- Low clamping factor
- Fast response time
- UL recognized

Complies with the following standards

- IEC 61000-4-2 level 4
 - 15 kV (air discharge)
 - 8 kV (contact discharge)
- MIL STD 883G, method 3015-7 Class 3
 - HBM (human body model)

**Description**

Transil diodes provide high overvoltage protection by clamping action. Their instantaneous response to transient overvoltages makes them particularly suited to protect voltage sensitive devices such as MOS Technology and low voltage supplied IC's.

TM:Transil is a trademarks of STMicroelectronics.

1 Characteristics

Table 1. Absolute maximum ratings ($T_{amb} = 25\text{ }^\circ\text{C}$)

| Symbol | Parameter | Value | Unit |
|-----------|-----------------------------------------------------------------------|-----------------------------------------------------------------|------------------|
| P_{PP} | Peak pulse power dissipation ⁽¹⁾ | $T_{j\text{ initial}} = T_{amb}$ 600 | W |
| P | Power dissipation on infinite heatsink | $T_{amb} = 75\text{ }^\circ\text{C}$ 5 | W |
| I_{FSM} | Non repetitive surge peak forward current for unidirectional types | $t_p = 10\text{ ms}$ $T_{j\text{ initial}} = T_{amb}$ 100 | A |
| T_{stg} | Storage temperature range | -65 to + 175 | $^\circ\text{C}$ |
| T_j | Maximum operating junction temperature | 175 | $^\circ\text{C}$ |
| T_L | Maximum lead temperature for soldering during 10 s at 5 mm from case. | 260 | $^\circ\text{C}$ |

1. For a surge greater than the maximum values, the diode will fail in short-circuit.

Table 2. Thermal resistances

| Symbol | Parameter | Value | Unit |
|---------------|-------------------------------------------------------------------|-------|--------------------|
| $R_{th(j-l)}$ | Junction to leads | 20 | $^\circ\text{C/W}$ |
| $R_{th(j-a)}$ | Junction to ambient on printed circuit. $L_{lead} = 10\text{ mm}$ | 75 | |

Figure 1. Electrical characteristics - definitions

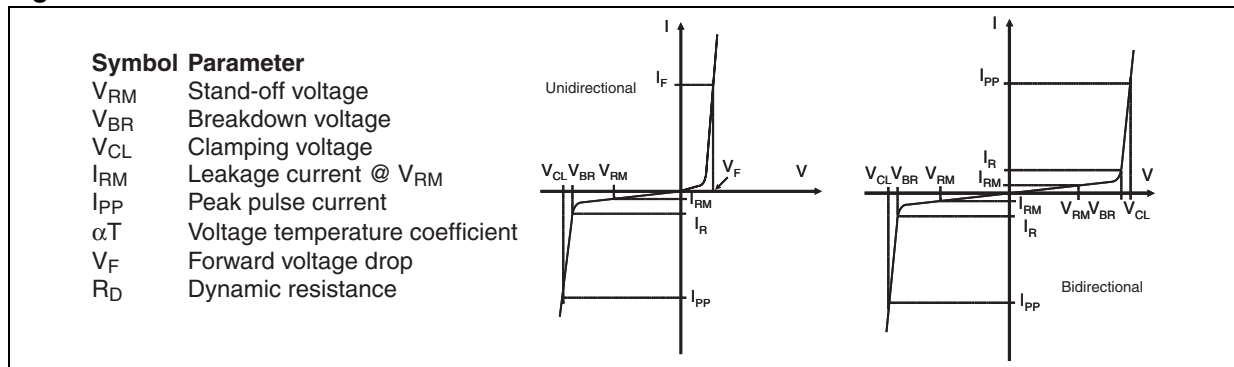


Figure 2. Pulse definition for electrical characteristics

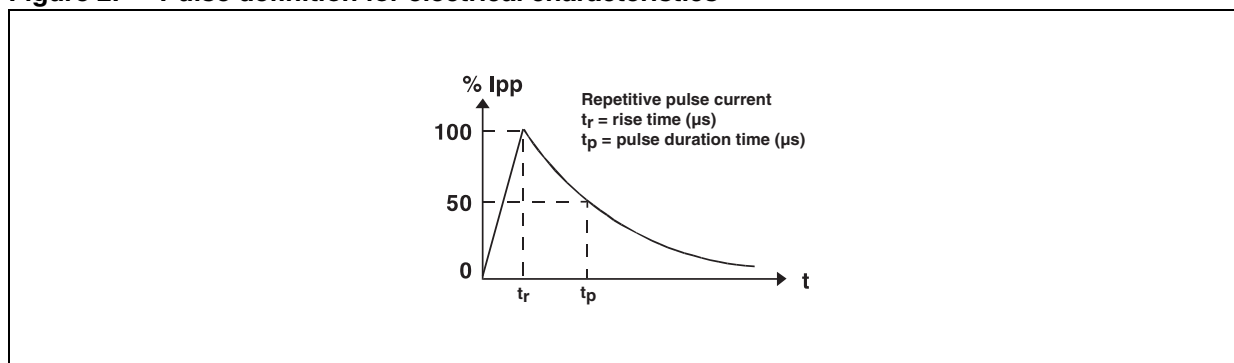


Table 3. Electrical characteristics - values ($T_{amb} = 25\text{ }^{\circ}\text{C}$)

| Order code | | $I_{RM} @ V_{RM}^{(1)}$ | | $V_{BR} @ I_R^{(2)}$ | | | | $V_{CL} @ I_{PP} 10/1000\ \mu\text{s}$ | | $V_{CL} @ I_{PP} 8/20\mu\text{s}$ | | $\alpha T^{(3)}$ | $C^{(4)}$ |
|----------------|---------------|-------------------------|------|----------------------|-----|------|----|----------------------------------------|------|-----------------------------------|------|----------------------------|-----------|
| | | max | | min | nom | max | | max | | max | | max | typ |
| Unidirectional | Bidirectional | μA | V | V | V | V | mA | V | A | V | A | $10^{-4}/^{\circ}\text{C}$ | pF |
| P6KE6V8A | P6KE6V8CA | 10 | 5.8 | 6.45 | 6.8 | 7.14 | 10 | 10.5 | 57 | 13.4 | 298 | 5.7 | 4000 |
| P6KE7V5A | P6KE7V5CA | 10 | 6.4 | 7.13 | 7.5 | 7.88 | 10 | 11.3 | 53 | 14.5 | 276 | 6.1 | 3700 |
| P6KE10A | P6KE10CA | 1 | 8.55 | 9.5 | 10 | 10.5 | 1 | 14.5 | 41 | 18.6 | 215 | 7.5 | 2800 |
| P6KE12A | P6KE12CA | 0.5 | 10 | 11.4 | 12 | 12.6 | 1 | 16.7 | 36 | 21.7 | 184 | 7.8 | 2300 |
| P6KE15A | P6KE15CA | 0.5 | 13 | 14.3 | 15 | 15.8 | 1 | 21.2 | 28 | 27.2 | 147 | 8.4 | 1900 |
| P6KE18A | P6KE18CA | 0.5 | 15 | 17.1 | 18 | 18.9 | 1 | 25.2 | 24 | 32.5 | 123 | 8.8 | 1600 |
| P6KE22A | P6KE22CA | 0.5 | 19 | 20.9 | 22 | 23.1 | 1 | 30.6 | 20 | 39.3 | 102 | 9.2 | 1350 |
| P6KE24A | P6KE24CA | 0.5 | 20 | 22.8 | 24 | 25.2 | 1 | 33.2 | 18 | 42.8 | 93 | 9.4 | 1250 |
| P6KE27A | P6KE27CA | 0.5 | 23 | 25.7 | 27 | 28.4 | 1 | 37.5 | 16 | 48.3 | 83 | 9.6 | 1150 |
| P6KE30A | P6KE30CA | 0.5 | 26 | 28.5 | 30 | 31.5 | 1 | 41.5 | 14.5 | 53.5 | 75 | 9.7 | 1075 |
| P6KE33A | P6KE33CA | 0.5 | 28 | 31.4 | 33 | 34.7 | 1 | 45.7 | 13.1 | 59 | 68 | 9.8 | 1000 |
| P6KE36A | P6KE36CA | 0.5 | 31 | 34.2 | 36 | 37.8 | 1 | 49.9 | 12 | 64.3 | 62 | 9.9 | 950 |
| P6KE39A | P6KE39CA | 0.5 | 33 | 37.1 | 39 | 41.0 | 1 | 53.9 | 11.1 | 69.7 | 57 | 10.0 | 900 |
| P6KE47A | P6KE47CA | 0.5 | 40 | 44.7 | 47 | 49.4 | 1 | 64.8 | 9.3 | 84 | 48 | 10.1 | 800 |
| P6KE56A | P6KE56CA | 0.5 | 48 | 53.2 | 56 | 58.8 | 1 | 77 | 7.8 | 100 | 40 | 10.3 | 700 |
| P6KE68A | P6KE68CA | 0.5 | 58 | 64.6 | 68 | 71.4 | 1 | 92 | 6.5 | 121 | 33 | 10.4 | 625 |
| P6KE82A | P6KE82CA | 0.5 | 70 | 77.9 | 82 | 86.1 | 1 | 113 | 5.3 | 146 | 27 | 10.5 | 550 |
| P6KE100A | P6KE100CA | 0.5 | 85 | 95.0 | 100 | 105 | 1 | 137 | 4.4 | 178 | 22.5 | 10.6 | 500 |
| P6KE120A | P6KE120CA | 0.5 | 102 | 114 | 120 | 126 | 1 | 165 | 3.6 | 212 | 19 | 10.7 | 450 |
| P6KE150A | P6KE150CA | 0.5 | 128 | 143 | 150 | 158 | 1 | 207 | 2.9 | 265 | 15 | 10.8 | 400 |
| P6KE180A | P6KE180CA | 0.5 | 154 | 171 | 180 | 189 | 1 | 246 | 2.4 | 317 | 12.6 | 10.8 | 360 |
| P6KE200A | P6KE200CA | 0.5 | 171 | 190 | 200 | 210 | 1 | 274 | 2.2 | 353 | 11.3 | 10.8 | 350 |
| P6KE220A | P6KE220CA | 0.5 | 188 | 209 | 220 | 231 | 1 | 328 | 1.85 | 388 | 10.3 | 10.8 | 330 |
| P6KE250A | P6KE250CA | 0.5 | 213 | 237 | 250 | 263 | 1 | 344 | 1.75 | 442 | 9 | 11 | 310 |
| P6KE300A | P6KE300CA | 0.5 | 256 | 285 | 300 | 315 | 1 | 414 | 1.45 | 529 | 7.6 | 11 | 290 |
| P6KE350A | P6KE350CA | 0.5 | 299 | 332 | 350 | 368 | 1 | 482 | 1.25 | 618 | 6.5 | 11 | 270 |
| P6KE400A | P6KE400CA | 0.5 | 342 | 380 | 400 | 420 | 1 | 548 | 1.1 | 706 | 5.7 | 11 | 360 |
| P6KE440A | P6KE440CA | 0.5 | 376 | 418 | 440 | 462 | 1 | 603 | 1.0 | 776 | 5.2 | 11 | 350 |

1. For bidirectional types having $V_{RM} \leq 10\text{V}$, I_{RM} is multiplied by 2
2. Pulse test: $t_p < 50\text{ ms}$.
3. $\Delta V_{BR} = \alpha T * (T_{amb} - 25) * V_{BR}(25^{\circ}\text{C})$.
4. $V_R = 0\text{ V}$, $F = 1\text{ MHz}$. For bidirectional types, capacitance value is divided by 2.

Figure 3. Peak power dissipation vs. initial junction temperature (printed circuit board)

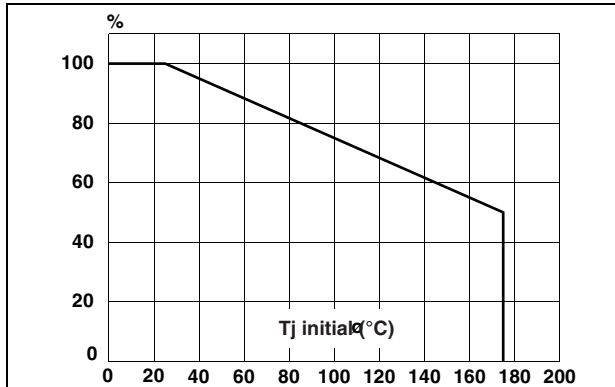


Figure 4. Peak pulse power vs. exponential pulse duration.

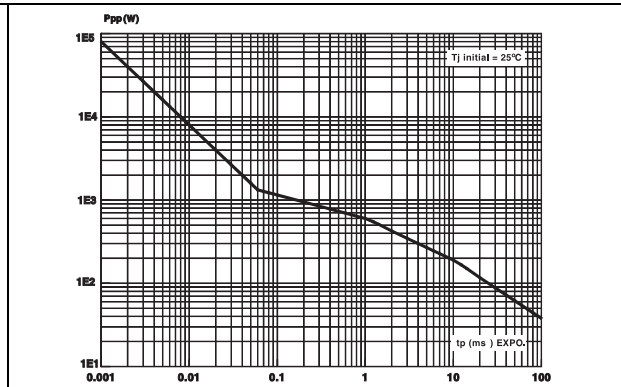


Figure 5. Clamping voltage vs. peak pulse current⁽¹⁾

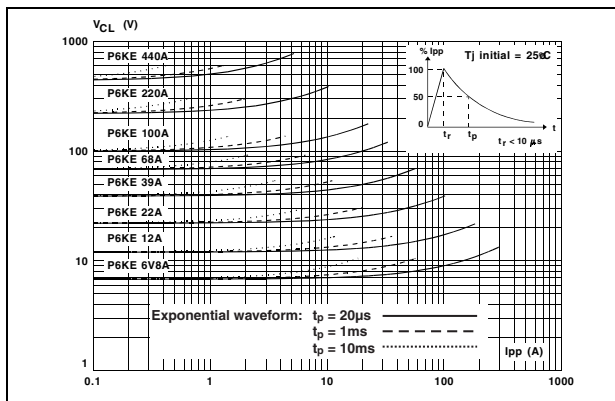
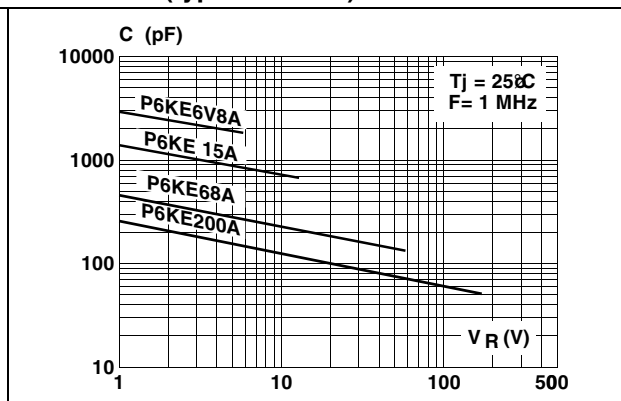


Figure 6. Capacitance vs. reverse applied voltage for unidirectional types (typical values).



1. The curves in Figure 5 are specified for a junction temperature of 25°C before surge. The given results may be extrapolated for other junction temperatures by using the following formula : $\Delta V_{BR} = \alpha T \times [T_{amb} - 25] \times V_{BR}(25^\circ C)$
For intermediate voltages, extrapolate the given results.

Figure 7. Capacitance vs. reverse applied voltage for bidirectional types (typical values).

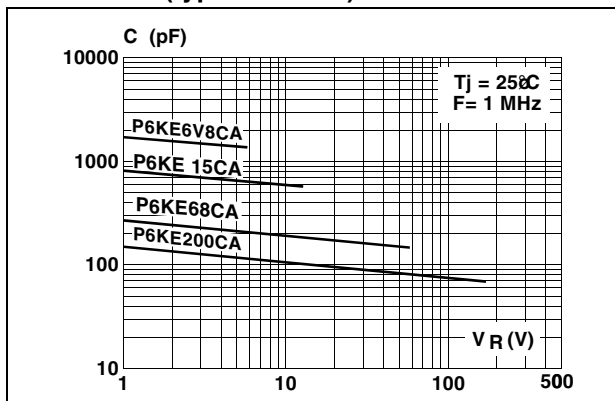
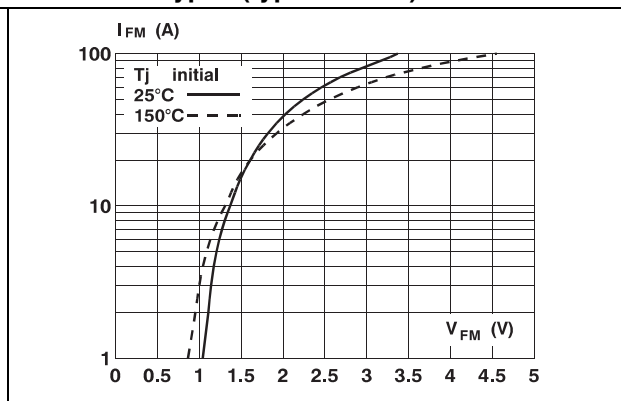


Figure 8. Peak forward voltage drop vs. peak forward current for unidirectional types (typical value).⁽¹⁾



1. Multiply by 2 for units with $V_{BR} > 220$ V.

Figure 9. Transient thermal impedance junction to ambient vs. pulse duration

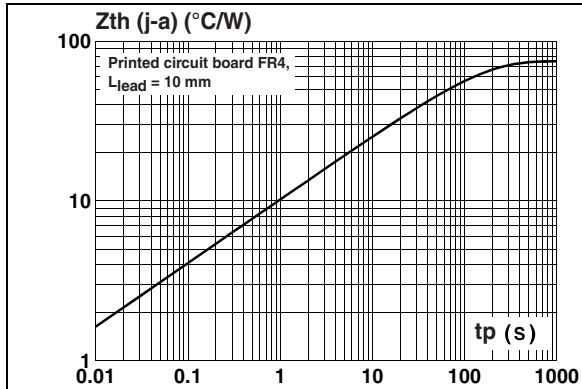
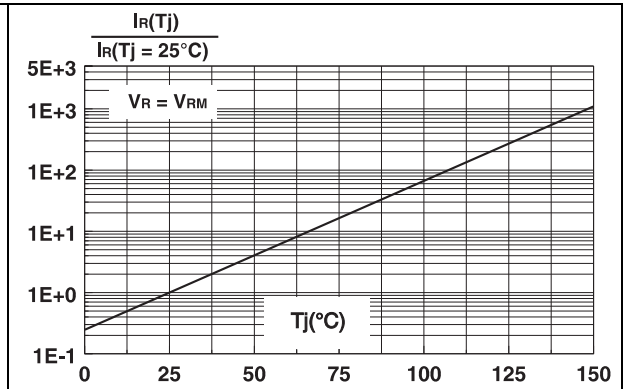
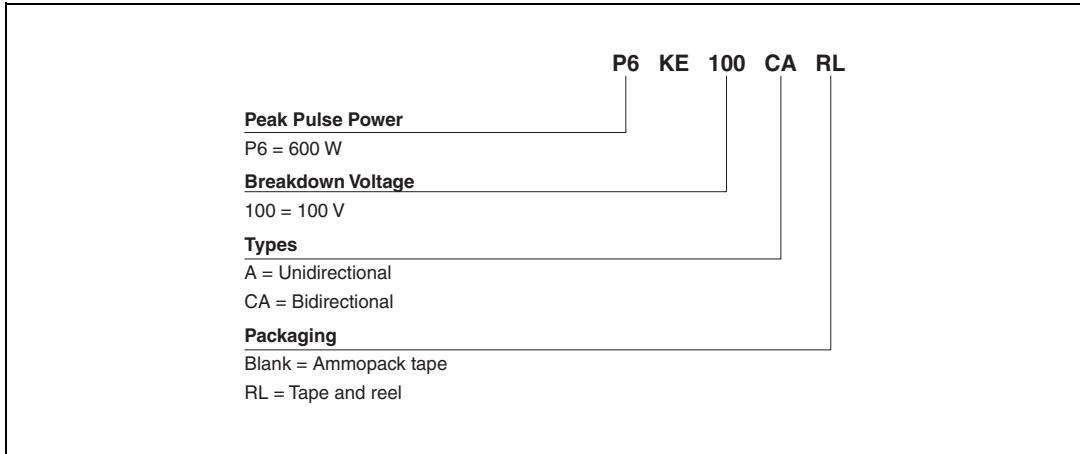


Figure 10. Relative variation of leakage current vs. junction temperature



2 Ordering information scheme

Figure 11. Ordering information scheme



3 Package information

- Epoxy meets UL94, V0
- Lead-free package

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

Table 4. DO-15 dimensions

| Ref. | Dimensions | | | |
|------|-------------|------|--------|-------|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A | 6.05 | 6.75 | 0.238 | 0.266 |
| B | 2.95 | 3.53 | 0.116 | 0.139 |
| C | 26 | 31 | 1.024 | 1.220 |
| D | 0.71 | 0.88 | 0.028 | 0.035 |

Table 5. Marking

| Unidirectional order code | Marking ⁽¹⁾ | Bidirectional order code | Marking ⁽¹⁾ |
|---------------------------|-------------------------|--------------------------|--------------------------|
| P6KE6V8A | P6KE6V8A | P6KE6V8CA | P6KE6V8CA |
| P6KE7V5A | P6KE7V5A | P6KE7V5CA | P6KE7V5CA |
| P6KE10A | P6KE10A | P6KE10CA | P6KE10CA |
| P6KE12A | P6KE12A | P6KE12CA | P6KE12CA |
| P6KE15A | P6KE15A | P6KE15CA | P6KE15CA |
| P6KE18A | P6KE18A | P6KE18CA | P6KE18CA |
| P6KE22A | P6KE22A | P6KE22CA | P6KE22CA |
| P6KE24A | P6KE24A | P6KE24CA | P6KE24CA |
| P6KE27A | P6KE27A | P6KE27CA | P6KE27CA |
| P6KE30A | P6KE30A | P6KE30CA | P6KE30CA |
| P6KE33A | P6KE33A | P6KE33CA | P6KE33CA |
| P6KE36A | P6KE36A | P6KE36CA | P6KE36CA |
| P6KE39A | P6KE39A | P6KE39CA | P6KE39CA |
| P6KE47A | P6KE47A | P6KE47CA | P6KE47CA |
| P6KE56A | P6KE56A | P6KE56CA | P6KE56CA |
| P6KE68A | P6KE68A | P6KE68CA | P6KE68CA |
| P6KE82A | P6KE82A | P6KE82CA | P6KE82CA |
| P6KE100A | P6KE100A | P6KE100CA | P6KE100CA |
| P6KE120A | P6KE120A | P6KE120CA | P6KE120CA |
| P6KE150A | P6KE150A | P6KE150CA | P6KE150CA ⁽²⁾ |
| P6KE180A | P6KE180A | P6KE180CA | P6KE180CA |
| P6KE200A | P6KE200A | P6KE200CA | P6KE200CA |
| P6KE220A | P6KE220A | P6KE220CA | P6KE220CA |
| P6KE250A | P6KE250A | P6KE250CA | P6KE250CA |
| P6KE300A | P6KE300A | P6KE300CA | P6KE300CA |
| P6KE350A | P6KE350A | P6KE350CA | P6KE350CA |
| P6KE400A | P6KE400A ⁽²⁾ | P6KE400CA | P6KE400CA |
| P6KE440A | P6KE440A ⁽²⁾ | P6KE440CA | P6KE440CA |

1. Includes a space character after P6KE for ECOPACK2 compliant devices

2. Includes a space character after P6KE for ECOPACK1 compliant devices in tape and reel packaging.

4 Ordering information

Table 6. Ordering information

| Order code | Marking ⁽¹⁾ | Package | Weight | Base qty | Delivery mode |
|------------|-----------------------------|---------|--------|----------|---------------|
| P6KExxxx | See Table 5 | DO-15 | 0.4 g | 1000 | Ammopack |
| P6KExxxxRL | | | | 6000 | Tape and reel |

1. Logo, date code, type code, cathode band (for unidirectional types only).

5 Revision history

Table 7. Document revision history

| Date | Revision | Changes |
|-------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Feb-2003 | 4A | Last update |
| Oct-2004 | 5 | 1/ Note 5, figure 7 on page 4, updated from $V_{BR} > 220V$ to $V_{BR} \geq 200V$. 2/ Types table on page 2: I_{PP} (@10/1000 μ s) changed for P6KE220xx to P6KE440xx |
| 14-Sep-2011 | 6 | Updated I_{RM} @ V_{RM} values, V_{BRmax} @ I_R for P6KE33 and order codes in Table 3 . Updated footnotes to Table 5 . Updated T_L temperature in Table 1 . |
| 26-Apr-2012 | 7 | Corrected typographical area Table 3 . |

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY TWO AUTHORIZED ST REPRESENTATIVES, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2012 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com